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Case Report

A Modified Approach of Cystic Puncture With Contrast Medium Injection for Diagnosis of Obstructed Hemivagina and Urinary Tract Anomalies

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This study investigated the diagnostic value of a modification of the conventional technique of X-ray imaging after cystic puncture with injection of contrast medium for obstructed hemivagina and related urinary tract anomalies in girls. The modified procedure made the following diagnostic findings: ipsilateral obstructed hemivagina in one patient with renal agenesis; vaginal ectopic ureter and ipsilateral obstructed hemivagina in one patient with renal dysplasia; and vaginal ectopic ureter, Gartner's duct cyst and ipsilateral obstructed hemivagina in six patients with renal dysplasia or aplasia. This modified method might have improved diagnostic value over the traditional method, and accurately identify genitourinary tract anomalies. It could therefore serve as an alternative and complementary method of sonography.

Key Words: Gartner's duct cyst, hemivagina, ureterocele-like cyst, urinary tract anomalies

Obstructed hemivagina is now most commonly diagnosed by sonography.[1] Sometimes more expensive procedures such as computed tomography (CT) or magnetic resonance imaging (MRI) are used. Before 1975, these three diagnostic instruments were either not available or were used primarily in research settings, and X-ray imaging after cystic puncture with injection of contrast medium[2,3] was the most important diagnostic method before operation. Aspiration of tenacious accumulated menstrual blood or mucus from the obstructed vagina via the vaginal orifice is very difficult; therefore, most of this fluid is not removed before dye injection. Thus the injected contrast medium is usually mixed with menstrual blood. The resulting fluid mixture maintains a high viscosity which makes it resistant to flow into the genitourinary system and its abnormalities. As a result, most images are of little diagnostic value, which explains the lack of widespread use of this method. Use of a modified method can improve such conditions.

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Patients and Methods

Patients

From 1990 to 2005, unilateral renal absence and ipsilateral obstructed hemivagina were found in eight girls by ultrasonography for screening at primary schools. Patient age at initial detection of renal anomaly ranged from 7 to 13 years. These girls received further examination, treatment and long-term follow-up at our hospital. Clinical data and various imaging studies are summarized in the Table.

Modified diagnostic method

The modification consisted of injection of small amounts of normal saline (about 1/5–1/10 of cystic volume) into the occluded vagina or other cyst after puncture, followed by aspiration of diluted menstrual blood or mucus. Injection and aspiration were performed repeatedly, until the dark red color of the removed accumulated menstrual blood became clear or nearly clear and aspiration became easy. X-ray images were obtained after cystic puncture with injection of contrast medium, and the dye was allowed to flow into the abnormal genitourinary tract.

For patients with Gartner's duct cyst, a small amount of saline was injected particularly if high fluid viscosity is encountered. Aspiration of the diluted fluid followed by repeated injection was performed until fluid aspiration was easy. This was followed by injection of dye and X-ray image collection.

Initial injection of normal saline was not required during ureteral puncture. Contrast medium was injected slowly after ureteral puncture. X-ray images were taken immediately after dye injection.

In the present series, vaginal puncture was performed in five girls, Gartner's duct cystic puncture in two, and ureteral puncture in one. Vaginal puncture was performed via the vaginal orifice, immediately after anesthesia during vaginal septectomy in cases 2–4, and just before vaginal septectomy following upper urinary tract surgery in case 5. No anesthesia was required and direct vaginal puncture was performed in case 1. Gartner's cystic duct and ureteral punctures were performed during abdominal operation in cases 6–8. The cystic puncture was made under echo guidance in case 3 and under direct vision in the remaining cases.

Results

Vaginal puncture with contrast cases 1–5 (Figures 1B and 2) revealed dilatation of the vaginal cavity, which was in agreement with the findings of sonography (Figures 1A and 2). Vaginal puncture with contrast revealed that the vagina communicated with a Gartner's duct cyst in cases 2 and 3 (Figure 2), and that the ureter directly inserted into the vagina in case 4.

Bladder cyst puncture with contrast was undertaken in cases 6 and 7 and revealed an atretic ureter that emptied into the cyst. Contrast material flow from the ureterocele-like cyst to the vagina, and backflow into the uterine cavity and fallopian tube were seen in case 6. No dye was found in the bladder of these patients. These findings confirmed that the ureterocele-like cyst was a Gartner's duct cyst and the ipsilateral genital tract was obstructed.

X-ray images from ureteral puncture with contrast injection in case 8 revealed dye flowing from the ureter and Gartner's duct cyst into the vagina (data not shown).

Incomplete obstruction of hemivagina was found in five patients (cases 3, 4 and 6–8). The connection between the two genital systems is via a cervical channel. (Figure 2)

Discussion

Although obstructed hemivagina traditionally has been considered as a rare congenital disease, the widespread use of abdominal sonography has led to the discovery of more cases. The method of cystic puncture with injection of contrast medium has been used in patients with obstructed hemivagina. Clinically, demonstration of filling of the uterus and a fallopian tube from a vaginal cystic

Table. Clinical presentation and imaging studies

Case	Age at initial evaluation (yr)	Menarche age (yr)	Renal anomalies	Symptoms/signs		Obstructed genital anomalies (at surgery)	Imaging studies			Sonographic findings	Age at CP (yr)	Surgery	Age at surgery (yr)
				Urinary system	Genital system		Sono	CT	MRI				
1	12	13	Renal agenesis (lack of one kidney)	—	Vaginal protruding mass	Left hydrocolpos	+	–	+	LRA; Double uteri with dilatation of HC	12	VS	13
2	7	13	Dysplastic kidney*	—	Dysmenorrhea	Left hematometrocolpos	+	–	+	LRA;Double uteri with dilatation of hemivaginal and uterine cavity with low level echoes and a Gartner's duct cyst beside VC with similar echoes	13	VS	13
3	8	13	Dysplastic kidney*	—	Abdominal pain; VD	RH	+	–	+	RRA; Double uteri with dilatation of HC with low level echoes and a Gartner's duct cyst beside VC with similar echoes	13	VS	13
4	13	12	Dysplastic kidney*	—	VD	LH	+	–	+	LRA; Double uteri with a dilated ureter inserted into the dilated VC	12	VS	12

(*Contd*)

Table. (Continued)

Case	Age at initial evaluation (yr)	Menarche age (yr)	Renal anomalies	Symptoms/signs		Obstructed genital anomalies (at surgery)	Imaging studies			Sonographic findings	Age at CP (yr)	Surgery	Age at surgery (yr)
				Urinary system	Genital system		Sono	CT	MRI				
5	10	12	Upper pole dysplasia of duplex kidney†	Urinary dripping	—	Left hydrocolpos	+	−	+	Cystic changes of the upper pole in duplex kidney with a dilated ureter emptying into a Gartner's duct cyst beside the vagina; dilatation of VC	12	Removal of upper pole of the left kidney and related ureter; VS	12/12
6	9	12	Aplasia‡	Straining to void and prolonged urination	Abdominal pain; VD	Right hematometrocolpos	+	+	+	RRA; a ureterocele-like cyst on the right side (initial evaluation); dilatation of unilateral uterine and VC (at surgery)	9	Removal of bladder cyst and related ureter; VS	9/12
7	9	12	Aplasia‡	Straining to void and prolonged urination	VD	LH	+	+	+	LRA; a ureterocele-like cyst on the left side (initial evaluation); dilatation of VC	9	Removal of bladder cyst and related ureter; VS	9/12
8	13	13	Dysplastic kidney*	Urinary dripping	VD	RH	+	+	+	RRA; dilatation of VC connecting to Gartner's duct cyst	13	Removal of hydrodysplastic kidney; VS	13/12

**Small, ectopic kidney and loss of normal renal architecture; †multiple cystic change; ‡lack of renal parenchyma. RH = Right hematocolpos; LH = left hematocolpos; Sono = sonography; CT = computed tomography; MRI = magnetic resonance imaging; LRA = left renal absence; RRA = right renal absence; HC = hemivaginal cavity; VC = vaginal cavity; VS = vaginal septectomy.*

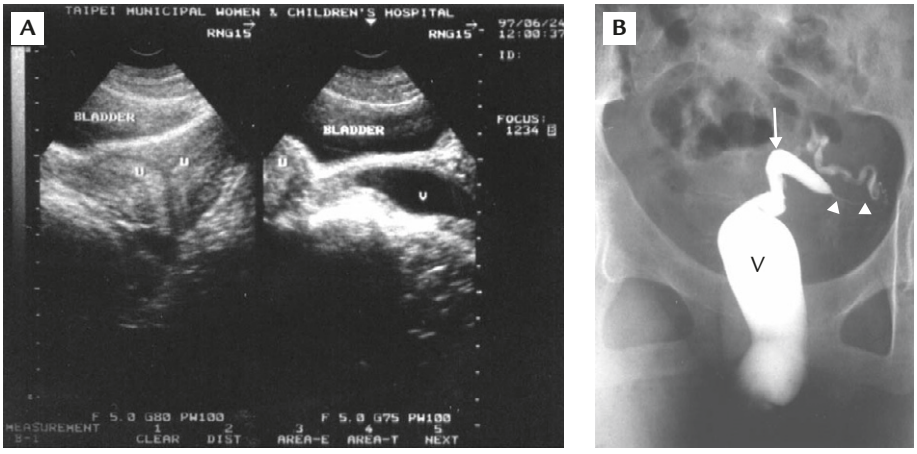

Figure 1. (A) (Case 1) Pelvic sonography revealed double uteri (U) and dilatation of the left vaginal cavity (V). (B) Vaginal puncture with contrast on the left side revealed dilatation of the vaginal cavity (V). The dye flowed from the vaginal cavity into the uterine cavity (arrow) and fallopian tube (arrowheads).

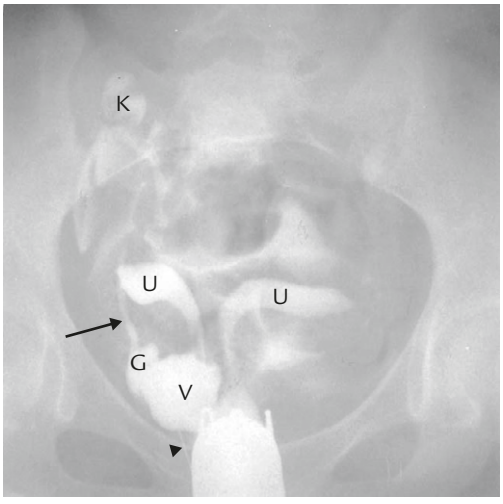

Figure 2. (Case 3) Vaginal puncture with contrast (arrowhead) on the left side after artificial occlusion of the left cervical os revealed dye flowing from the right obstructed vagina (V) to the Gartner's duct cyst (G), ipsilateral ureter (arrow), dysplastic kidney (K) and uteri (U). The image also demonstrates the connection of two genital systems via a cervical channel. (Reprinted with permission[16])

mass following injection of contrast material is diagnostic for obstructed hemivagina.[2,3]

The accumulated menstrual blood in the vagina usually has a sticky consistency, and aspiration of tenacious menstrual blood or mucus in the vagina via the vaginal orifice is difficult and most fluid usually cannot be removed. In this situation, when contrast medium is directly injected into the obstructed hemivagina, it might mix with accumulated menstrual blood. This fluid mixture might maintain high viscosity and pool in the vagina instead of flowing freely in the genitourinary system. Therefore, X-rays do not reveal the full picture of the abnormal genitourinary tract or demonstrate obstructed hemivagina.

In 1972, Vinstein suggested that hysterosalpingography should be performed on the side opposite the vaginal-obstructing mass because it can delineate a unicornuate uterus and indirectly demonstrate the existence of obstructed hemivagina on the other side. However, more complicated urinary tract anomalies related to obstructed hemivagina, such as vaginal ectopic ureter,[4–6] might not be demonstrated by this method.

In the present study, the conventional procedure of cystic puncture with injection of contrast material was modified to inject a small amount of normal saline into occluded hemivagina after cystic puncture, to dissolve menstrual blood in saline and increase intravaginal pressure. After injection of saline into the vagina, the aspiration of diluted blood became easier. Both injection and aspiration were performed repeatedly until the dark red color of accumulated menstrual blood disappeared. This modification of the technique could improve its ability to delineate abnormal genitourinary structures.

Obstructed hemivagina is always associated with ipsilateral renal agenesis or renal dysgenesis with vaginal ectopic ureter.[4–6] There are two types of vaginal ectopic ureter. In the first type, an ectopic ureter inserts directly into the vaginal cavity.[4]

In the second type, the ectopic ureter empties into a Gartner's duct cyst in the vaginal wall.[7–15] Embryologically, a Gartner's duct cyst is the cystic remnant of the Wolffian duct that extends down the anterolateral margin of the vagina. Although it usually presents posterior to the bladder, if it protrudes into the bladder, it might present as a ureterocele.[16,17] When the ureter empties into a Gartner's duct cyst, the cyst might become enlarged. Under such conditions, the Gartner's duct cyst might cover the ipsilateral vagina in the anterior–posterior view in early life.[8,9,11,14]

Mackie and Stephens have proposed that the severity of renal maldevelopment is directly related to the degree of ectopia.[10] An ectopic ureter inserted into a Gartner's duct cyst is often severely obstructed. During early gestation, urinary obstruction with such an ectopic ureter usually develops into severe dysplasia of the involved kidney. Patients with unilateral renal dysgenesis and Gartner's duct cyst have been reported to have a high frequency (> 50%) of ipsilateral obstructed hemivagina.[11–14] In girls with such anomalies, the ureter is frequently not dilated (Figure 2). The corresponding dysplastic kidney is small with extremely poor function (Figure 2) or even no function. Its position often is ectopic and is usually located in the pelvic region near the pelvic rim (Figure 2). Sonography, CT or MRI often cannot completely detect these extremely maldeveloped portions of the urinary tract. The modified technique of cystic puncture with injection of contrast medium can delineate these abnormal structures and disclose the obvious relationships among genitourinary anomalies (Figures 1 and 2). These findings can provide accurate diagnosis of obstructed hemivagina.

Obstructed hemivagina is also classified into two types. In the first type, the hemivaginal obstruction is complete and no blood leak from the vagina orifice is found. In the second type, the hemivaginal obstruction is incomplete, and bloody purulent discharge is seen between menstrual periods after menarche. Sometimes spontaneous rupture of the uterovaginal septum may occur; therefore, the complete hemivaginal obstruction becomes incomplete.[15] The sites of leakage might include the cervix, common vaginal septum, or both. A leakage site on the vaginal septum is directly visible from the normal side of the vaginal orifice. When the leakage site is at the cervix, as in the present case 3 (Figure 2), artificial occlusion of the opposite cervix is performed to maintain an intact closed space during the modified diagnostic procedure. Under such conditions, the contrast medium flows into all abnormal areas of the genitourinary system. X-rays have been used to demonstrate double uteri with obstructed hemivagina and related urinary tract abnormalities.[15]

The puncture site is often made in the vaginal septum via the vaginal orifice. Puncture of other genitourinary structures, such as Gartner's duct cyst and ureter might be required.

Sonography has now become the most important method for diagnosis of obstructed hemivagina. However, because X-ray imaging using the modified technique of cystic puncture with injection of contrast medium can provide more diagnostic information than sonography, CT or MRI, it remains an important tool for demonstrating obstructed hemivagina or ipsilateral urinary tract anomalies, which is important for surgical planning. After vaginal septectomy in girls with obstructed hemivagina and urinary tract anomalies, recurrent urinary tract infection, hypertension and urinary dripping might occur. A second operation for removal of the dysplastic kidney and ureter might be needed, and the use of a modified technique for delineation of genitourinary tract anomalies provides information for planning such a second operation. This technique might be particularly valuable in areas of the world without the availability of expensive equipment as an alternative or complementary method to sonography for diagnosis of obstructed hemivagina and related urinary tract anomalies.

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